How to select the correct size DS6 soft starter for standard duty applications

Application

The DS6 is a two phase control soft starter utilized to accomplish motor starting using the reduced voltage method. Typically, the motor horsepower or kW rating is used to determine the required size of the soft starter. This document addresses other factors that require consideration in accomplishing the proper match of soft starter to the load.

Overview

Soft starter sizing is typically determined by the horsepower or kW rating of the motor, coupled with the mains operating voltage. Using this information, a table or graph is consulted to determine the minimum size of the soft starter for the application. If the application is considered to be severe duty, it is commonplace to select the next size larger soft starter to accommodate the higher load currents.

The initial graphs and tables published for the DS6 are based on an inrush value of 300% FLA of the motor. If the actual inrush current approaches a value of 400% FLA, the maximum allowable ramp times are significantly affected. Additionally, the ramp times also must be considered independently, as when the ramp times are increased even though the inrush current does not change, the maximum allowable current capacity is reduced. When selecting the size of the DS6 soft starter, Tables 1–4 may be used if the anticipated ramp times are 10 seconds or less. Please note that either 300% or 400% current limit refers to the maximum anticipated start current in terms of motor FLA (3x or 4x). The DS6 does not have a current limiter function. If the ramp times are expected to be longer, Tables 5–12 should be reviewed to ensure that the soft starter is not subjected to excessive current resulting in SCR failure. The size of the soft starter may be required to be increased specifically due to a longer ramp time.

Note: The DS6 soft starter may be incorrectly sized if based solely on motor horsepower or kW rating and mains voltage alone.

The DS6 soft starter requires that specific attention is given to two factors:

Ultimate load—the maximum inrush current that the soft starter will transmit anytime during the start process.

Ramp time—the expected, or required, ramp time required for the motor to achieve synchronous speed.

Example 1—30 hp motor (40A FLA) @ 460V application, maximum current 300% FLA with an estimated start ramp time of 8 seconds, 4 starts per hour. Consulting Table 1, the DS6-34DSX041NO-N soft starter shows an acceptable maximum motor size of 30 hp. Consulting Table 5, the maximum allowable start current is listed as 121A. Under these conditions, a DS6-34DSX041NO-N soft starter is the appropriate selection for this application.

Example 2—With the same operating conditions as in Example 1, it is determined that the ramp time must be extended to 12 seconds for the motor to achieve synchronous speed. Consulting Table 5, the maximum allowable start current @ 12 seconds is listed as 104A, less than the required 120A. Table 6 for the next higher size soft starter lists the maximum allowable start current @ 12 seconds as 140A. Under these conditions, the DS6-34DSX041NO-N soft starter would not be an appropriate selection. The next size higher soft starter, DS6-34DSX055NO-N, is the suitable choice, as the maximum allowable start current for these conditions is sufficient for proper operation.

Example 3—With the same operating conditions as in Example 1, it is determined that the inrush current requires a 400% current limit. This operating condition will also require a larger capacity soft starter (DS6-DSX055NO-N) to accommodate the higher operating current during the start ramp.

Table 1. 10 Second Ramp, 1 Start per Hour, 300% Current Limit @ 40°C

300% Current Limit 10 Second Ramp	Rated Current	Motor Power (hp)				4/hr @ 40°C
Catalog Number	(A)	200V	230V	460V	Breaker ①	Fuse ①
DS6-34DSX041NO-N	40	10	10	30	HFD3150L	150A Class RK5
DS6-34DSX055NO-N	52	15	20	40	HFD3200L	200A Class RK5
DS6-34DSX068NO-N	65	20	25	50	HJD3250	200A Class RK5
DS6-34DSX081NO-N	77	25	30	60	HKD3300	300A Class RK5
DS6-34DSX099NO-N	96	30	30	75	HKD3350	350A Class RK5
DS6-34DSX134NO-N	124	40	50	100	HKD3350	500A Class RK5
DS6-34DSX161NO-N	156	50	60	125	HLD3450	500A Class RK5
DS6-34DSX196NO-N	180	60	75	150	HLD3500	500A Class RK5

① Maximum values are higher than allowed per NEC® 430.52 and UL® 508A 31.1.

Table 2. 10 Second Ramp, 1 Start per Hour, 400% Current Limit @ 40°C

400% Current Limit 10 Second Ramp	Rated Current	Motor Power (hp)				4/hr @ 40°C
Catalog Number	(A)	200V	230V	460V	Breaker ①	Fuse ①
DS6-34DSX041NO-N	27	7.5	10	20	HFD3150L	150A Class RK5
DS6-34DSX055NO-N	34	10	10	30	HFD3200L	200A Class RK5
DS6-34DSX068NO-N	40	15	15	30	HJD3250	200A Class RK5
DS6-34DSX081NO-N	52	15	20	40	HKD3300	300A Class RK5
DS6-34DSX099NO-N	65	20	25	50	HKD3350	350A Class RK5
DS6-34DSX134NO-N	80	30	30	75	HKD3350	500A Class RK5
DS6-34DSX161NO-N	96	30	40	75	HLD3450	500A Class RK5
DS6-34DSX196NO-N	124	40	50	100	HLD3500	500A Class RK5

① Maximum values are higher than allowed per NEC 430.52 and UL 508A 31.1.

Table 3. 10 Second Ramp, 1 Start per Hour, 300% Current Limit @ 40°C

300% Current Limit 10 Second Ramp	Rated Current	Motor Power (hp)			4/hr @ 40°C
Catalog Number	(A)	230V	400V	Breaker ①	Fuse ①
DS6-34DSX041NO-N	41	11	22	HFD3150L	150A Class RK5
DS6-34DSX055NO-N	55	15	30	HFD3200L	200A Class RK5
DS6-34DSX068NO-N	68	15	37	HJD3250	200A Class RK5
DS6-34DSX081NO-N	81	22	45	HKD3300	300A Class RK5
DS6-34DSX099NO-N	99	30	55	HKD3350	350A Class RK5
DS6-34DSX134NO-N	134	30	75	HKD3350	500A Class RK5
DS6-34DSX161NO-N	161	45	90	HLD3450	500A Class RK5
DS6-34DSX196NO-N	196	55	110	HLD3500	500A Class RK5

① Maximum values are higher than allowed per NEC 430.52 and UL 508A 31.1.

Table 4. 10 Second Ramp, 1 Start per Hour, 400% Current Limit @ 40°C

400% Current Limit 10 Second Ramp	Rated Current	Motor Power (hp)			4/hr @ 40°C
Catalog Number	(A)	230V	400V	Breaker ①	Fuse ①
DS6-34DSX041NO-N	28.8	7.5	11	HFD3150L	150A Class RK5
DS6-34DSX055NO-N	37.5	11	18.5	HFD3200L	200A Class RK5
DS6-34DSX068NO-N	46	11	22	HJD3250	200A Class RK5
DS6-34DSX081NO-N	56	15	30	HKD3300	300A Class RK5
DS6-34DSX099NO-N	68	18.5	37	HKD3350	350A Class RK5
DS6-34DSX134NO-N	90	22	45	HKD3350	500A Class RK5
DS6-34DSX161NO-N	106	30	55	HLD3450	500A Class RK5
DS6-34DSX196NO-N	134	37	75	HLD3500	500A Class RK5

① Maximum values are higher than allowed per NEC 430.52 and UL 508A 31.1.

Supporting documentation

Manuals	Reference Number
DS6 Instructional Leaflet	IL03901001E
DS6 Catalog	CA03901001E
Program Files	none
Outline Drawings	none

Note: In the event that additional help is needed, please contact the Technical Resource Center at 1-877-ETN-CARE, Option 2, Sub Option 2.

Table 5. DS6-34DSX041NO-N

41 Amps	Maximum Starting Current				
Ramp Time	**1/hr 25°C**	**1/hr 40°C**	**4/hr 40°C**	**10/hr 40°C**	**20/hr 40°C**
0.001	155A	136A	133A	129A	127A
3	152A	133A	131A	129A	127A
4	150A	131A	128A	126A	124A
5	149A	129A	126A	124A	121A
6	146A	128A	125A	121A	118A
7	145A	126A	123A	119A	115A
8	144A	125A	121A	117A	113A
9	142A	124A	120A	115A	111A
10	142A	123A	118A	114A	108A
12	123A	111A	104A	98A	94A
13	121A	108A	102A	96A	91A
15	117A	105A	99A	92A	87A
19	112A	101A	93A	86A	80A
20	111A	100A	92A	84A	79A
23	109A	97A	89A	81A	73A
26	108A	96A	87A	79A	67A
29	106A	94A	85A	77A	62A
30	105A	94A	85A	76A	60A

Table 6. DS6-34DSX055NO-N

55 Amps	Maximum Starting Current				
Ramp Time	**1/hr 25°C**	**1/hr 40°C**	**4/hr 40°C**	**10/hr 40°C**	**20/hr 40°C**
0.001	209A	183A	178A	173A	170A
3	204A	178A	176A	173A	170A
4	201A	175A	172A	169A	166A
5	199A	173A	170A	166A	162A
6	196A	171A	167A	163A	158A
7	195A	169A	164A	160A	155A
8	193A	168A	162A	157A	152A
9	191A	166A	160A	155A	148A
10	190A	165A	159A	153A	145A
12	165A	148A	140A	132A	126A
13	162A	145A	137A	129A	121A
15	157A	141A	132A	123A	116A
19	150A	135A	125A	115A	108A
20	149A	134A	123A	113A	106A
23	146A	131A	120A	109A	98A
26	144A	129A	117A	106A	89A
29	142A	127A	115A	103A	83A
30	141A	126A	114A	102A	81A

Table 7. DS6-34DSX068NO-N

68 Amps	Maximum Starting Current				
Ramp Time	**1/hr 25°C**	**1/hr 40°C**	**4/hr 40°C**	**10/hr 40°C**	**20/hr 40°C**
0.001	258A	226A	220A	214A	210A
3	253A	221A	217A	214A	210A
4	249A	217A	213A	209A	205A
5	246A	214A	210A	205A	200A
6	242A	212A	207A	201A	195A
7	241A	209A	203A	198A	191A
8	239A	208A	201A	194A	187A
9	236A	205A	198A	191A	183A
10	235A	204A	196A	189A	180A
12	204A	183A	173A	163A	155A
13	200A	180A	169A	159A	150A
15	194A	174A	164A	153A	144A
19	186A	167A	155A	142A	133A
20	185A	166A	153A	140A	131A
23	181A	162A	148A	135A	121A
26	178A	159A	145A	131A	110A
29	176A	157A	142A	127A	103A
30	174A	155A	140A	126A	100A

Table 8. DS6-34DSX081NO-N

81 Amps	Maximum Starting Current				
Ramp Time	**1/hr 25°C**	**1/hr 40°C**	**4/hr 40°C**	**10/hr 40°C**	**20/hr 40°C**
0.001	307A	269A	262A	255A	251A
3	301A	263A	259A	255A	251A
4	296A	258A	254A	249A	245A
5	293A	255A	250A	245A	238A
6	289A	252A	246A	240A	232A
7	287A	249A	242A	235A	228A
8	284A	248A	239A	231A	223A
9	281A	245A	236A	228A	219A
10	280A	243A	234A	225A	214A
12	243A	219A	206A	194A	185A
13	238A	214A	202A	190A	179A
15	231A	208A	195A	182A	171A
19	222A	199A	184A	170A	159A
20	220A	197A	182A	167A	156A
23	215A	193A	177A	160A	144A
26	212A	190A	173A	156A	131A
29	209A	186A	169A	151A	122A
30	208A	185A	167A	150A	119A

Table 9. DS6-34DSX099NO-N

99 Amps	Maximum Starting Current				
Ramp Time	**1/hr 25°C**	**1/hr 40°C**	**4/hr 40°C**	**10/hr 40°C**	**20/hr 40°C**
0.001	375A	329A	320A	312A	306A
3	368A	321A	317A	312A	306A
4	362A	316A	310A	304A	299A
5	359A	312A	305A	299A	291A
6	353A	308A	301A	293A	284A
7	351A	304A	296A	288A	278A
8	347A	303A	292A	282A	273A
9	344A	299A	289A	278A	267A
10	342A	297A	286A	275A	262A
12	297A	267A	252A	237A	226A
13	291A	262A	247A	232A	219A
15	282A	254A	238A	222A	209A
19	271A	243A	225A	207A	194A
20	269A	241A	222A	204A	191A
23	263A	235A	216A	196A	176A
26	260A	232A	211A	191A	161A
29	256A	228A	206A	185A	149A
30	254A	226A	205A	183A	146A

Table 10. DS6-34DSX134NO-N

134 Amps	Maximum Starting Current				
Ramp Time	**1/hr 25°C**	**1/hr 40°C**	**4/hr 40°C**	**10/hr 40°C**	**20/hr 40°C**
0	540A	482A	473A	440A	429A
3	532A	461A	462A	440A	429A
4	520A	450A	448A	424A	410A
5	511A	442A	437A	411A	395A
6	503A	436A	429A	400A	382A
7	497A	430A	421A	390A	370A
8	491A	425A	413A	381A	360A
9	486A	420A	407A	373A	335A
10	481A	416A	401A	365A	310A
12	434A	388A	379A	351A	272A
13	416A	371A	367A	344A	257A
15	398A	355A	329A	287A	231A
19	378A	337A	308A	264A	193A
20	374A	333A	304A	259A	185A
23	363A	323A	291A	245A	166A
26	354A	314A	281A	233A	150A
29	346A	307A	272A	223A	138A
30	343A	305A	269A	220A	134A

Table 11. DS6-34DSX161NO-N

160 Amps	Maximum Starting Current				
Ramp Time	**1/hr 25°C**	**1/hr 40°C**	**4/hr 40°C**	**10/hr 40°C**	**20/hr 40°C**
0	640A	571A	560A	521A	508A
3	631A	546A	548A	521A	508A
4	616A	533A	531A	503A	486A
5	606A	524A	518A	487A	468A
6	596A	516A	508A	474A	453A
7	589A	510A	498A	462A	439A
8	582A	504A	490A	452A	427A
9	576A	498A	482A	442A	397A
10	570A	493A	475A	433A	367A
12	514A	460A	449A	416A	322A
13	493A	440A	435A	408A	305A
15	472A	421A	390A	340A	274A
19	448A	399A	365A	313A	229A
20	443A	395A	360A	307A	219A
23	430A	383A	345A	290A	197A
26	420A	372A	332A	276A	178A
29	410A	364A	322A	264A	164A
30	407A	361A	319A	261A	159A

Table 12. DS6-34DSX196NO-N

196 Amps	Maximum Starting Current				
Ramp Time	**1/hr 25°C**	**1/hr 40°C**	**4/hr 40°C**	**10/hr 40°C**	**20/hr 40°C**
0	800A	714A	700A	652A	636A
3	788A	683A	685A	652A	636A
4	770A	667A	664A	628A	607A
5	757A	655A	648A	609A	585A
6	745A	646A	635A	593A	566A
7	736A	637A	623A	578A	548A
8	727A	630A	612A	564A	533A
9	720A	622A	602A	553A	496A
10	713A	616A	593A	541A	459A
12	643A	575A	561A	520A	403A
13	616A	550A	543A	510A	381A
15	590A	526A	488A	425A	342A
19	560A	499A	457A	391A	286A
20	554A	493A	450A	384A	274A
23	538A	479A	432A	363A	246A
26	524A	465A	416A	345A	222A
29	513A	455A	403A	330A	204A
30	508A	452A	399A	326A	199A

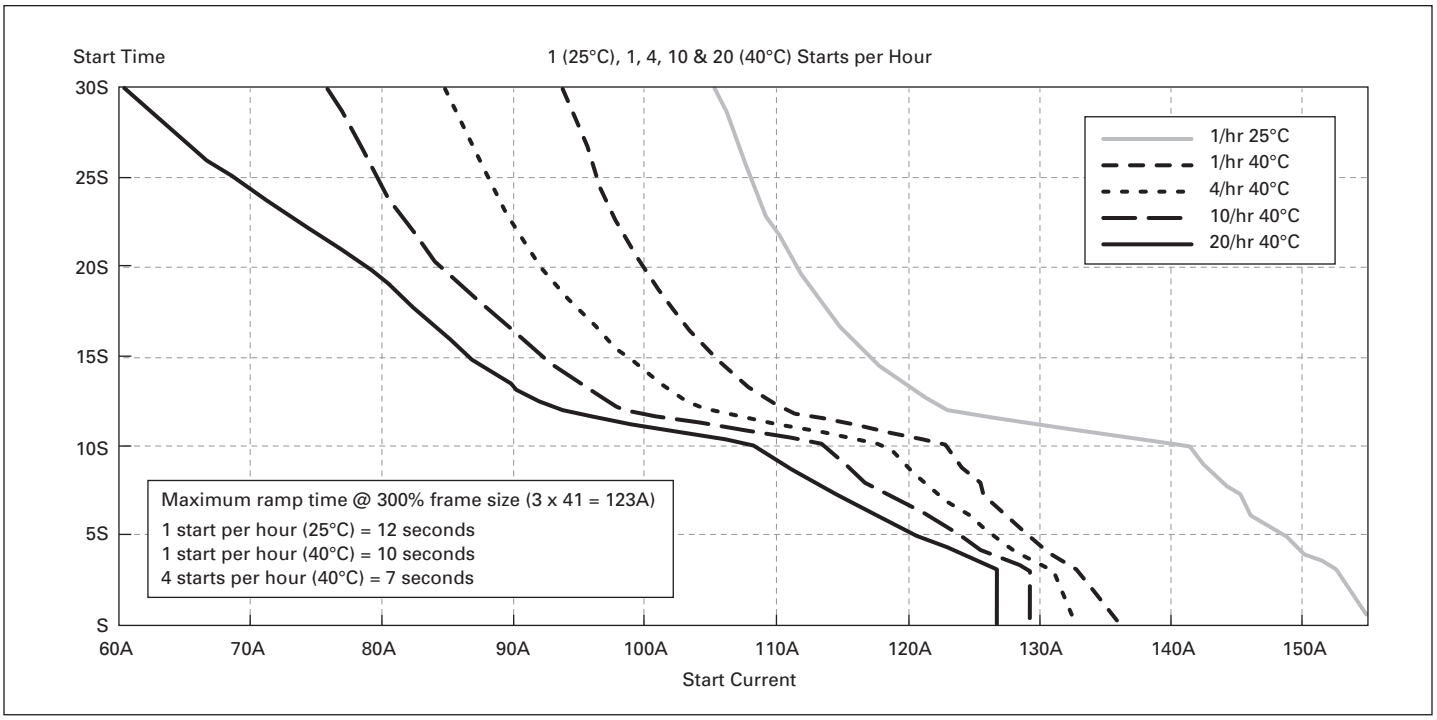

Figure 1. 41A Rated DS6-34DSX041NO-N

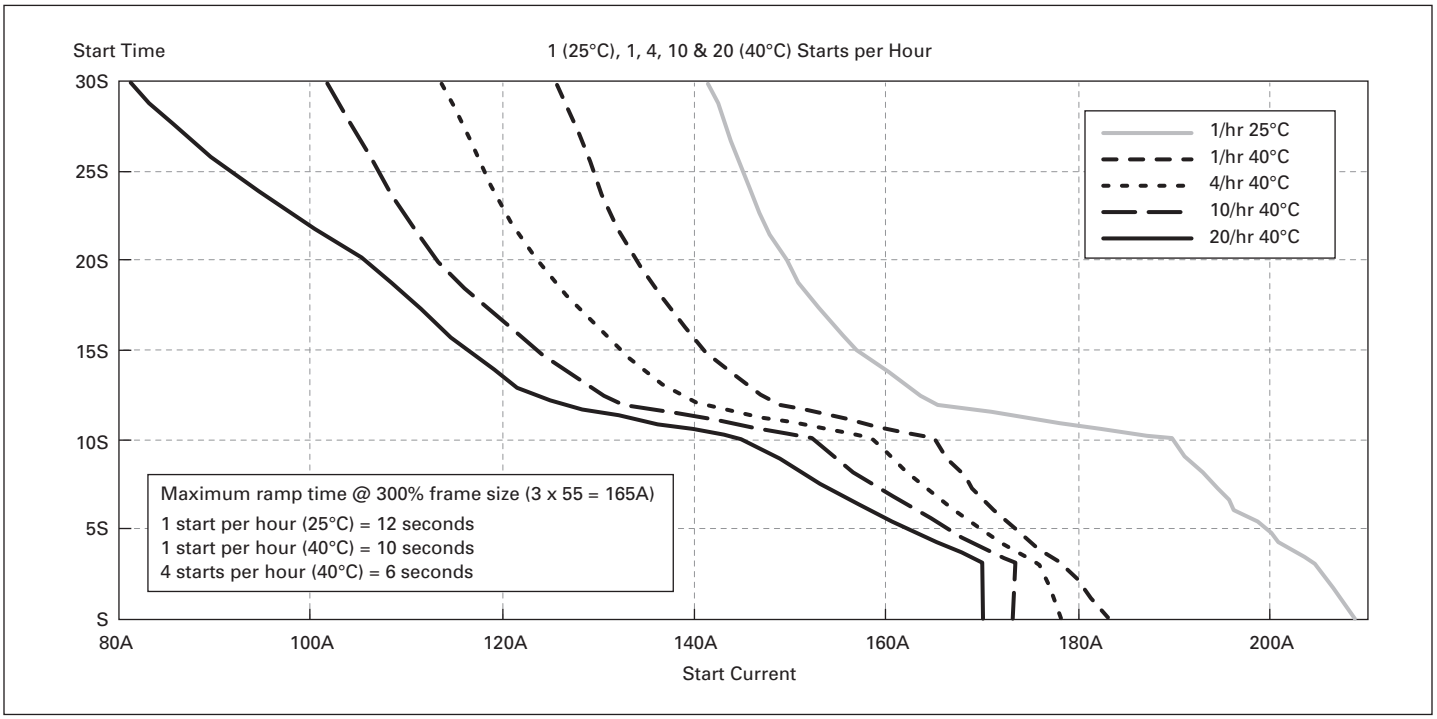

Figure 2. 55A Rated DS6-34DSX055NO-N

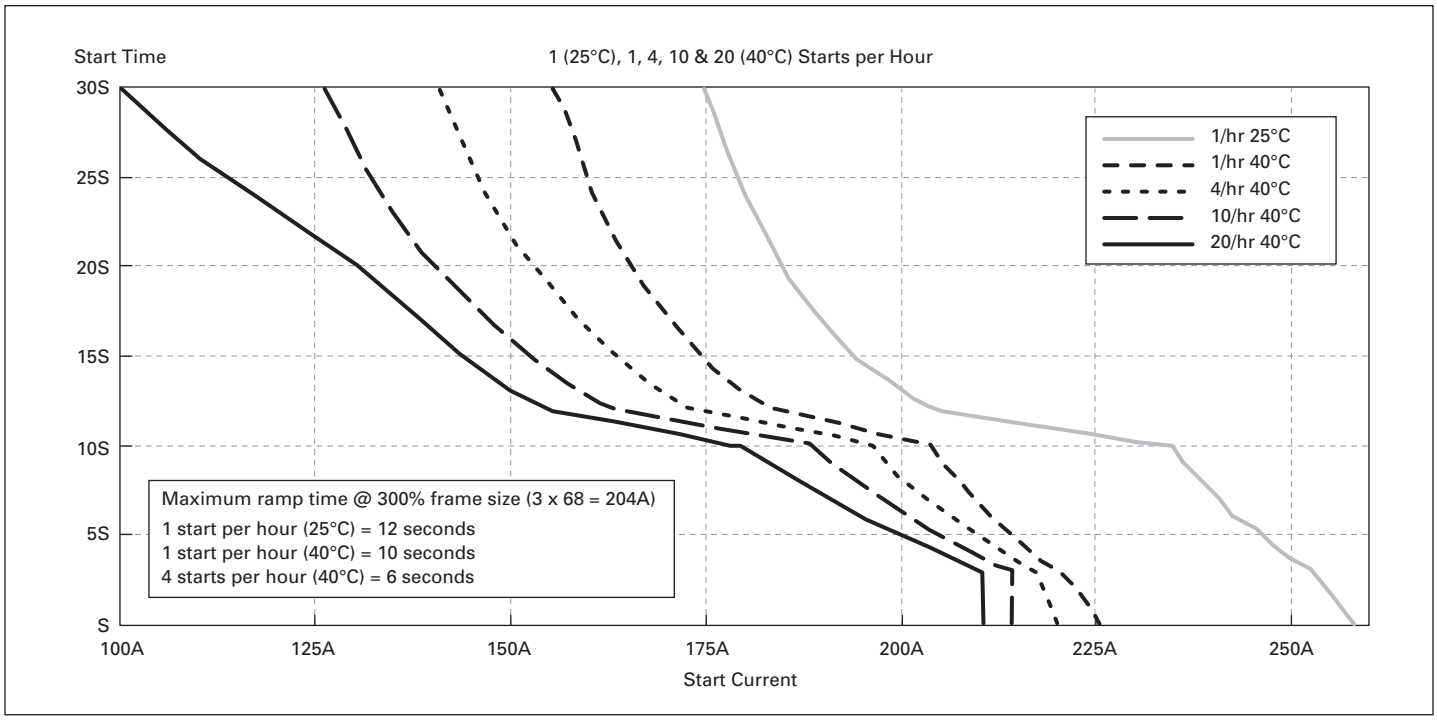

Figure 3. 68A Rated DS6-34DSX068NO-N

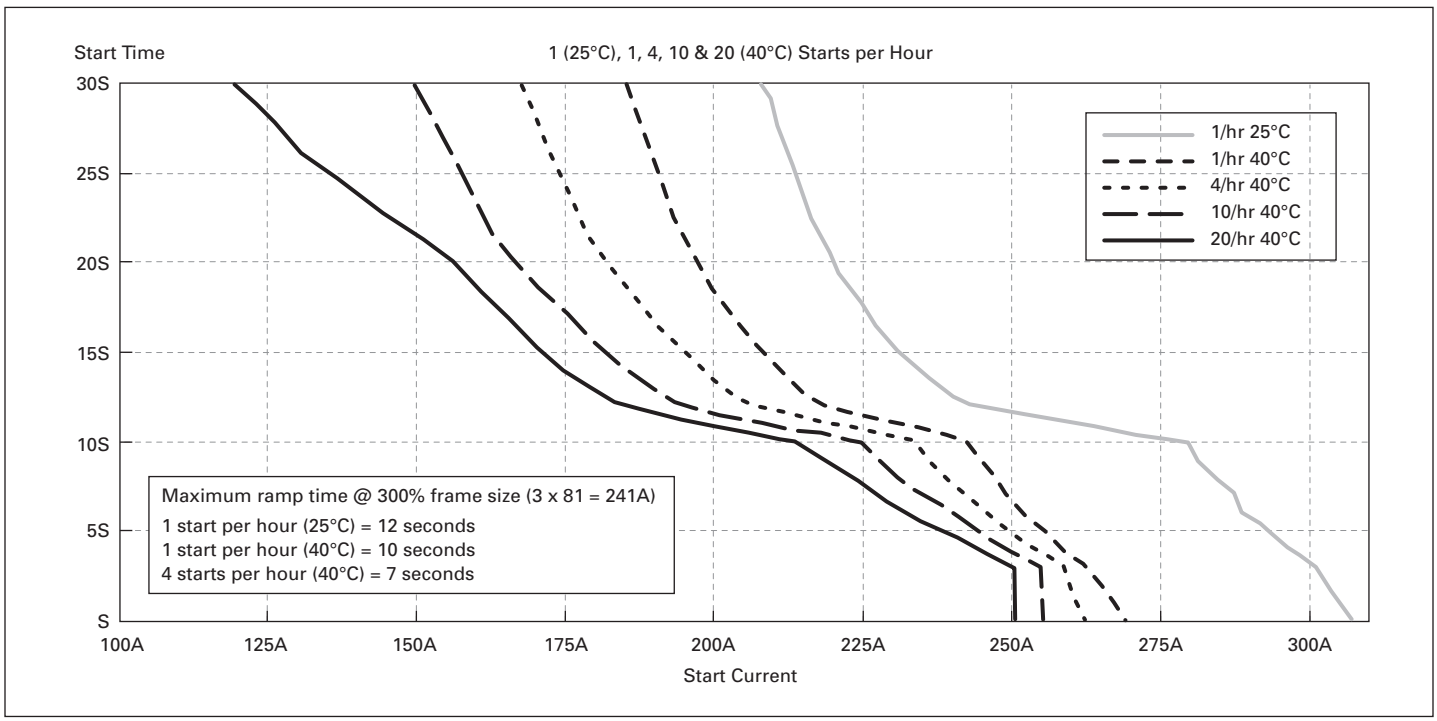

Figure 4. 81A Rated DS6-34DSX081NO-N

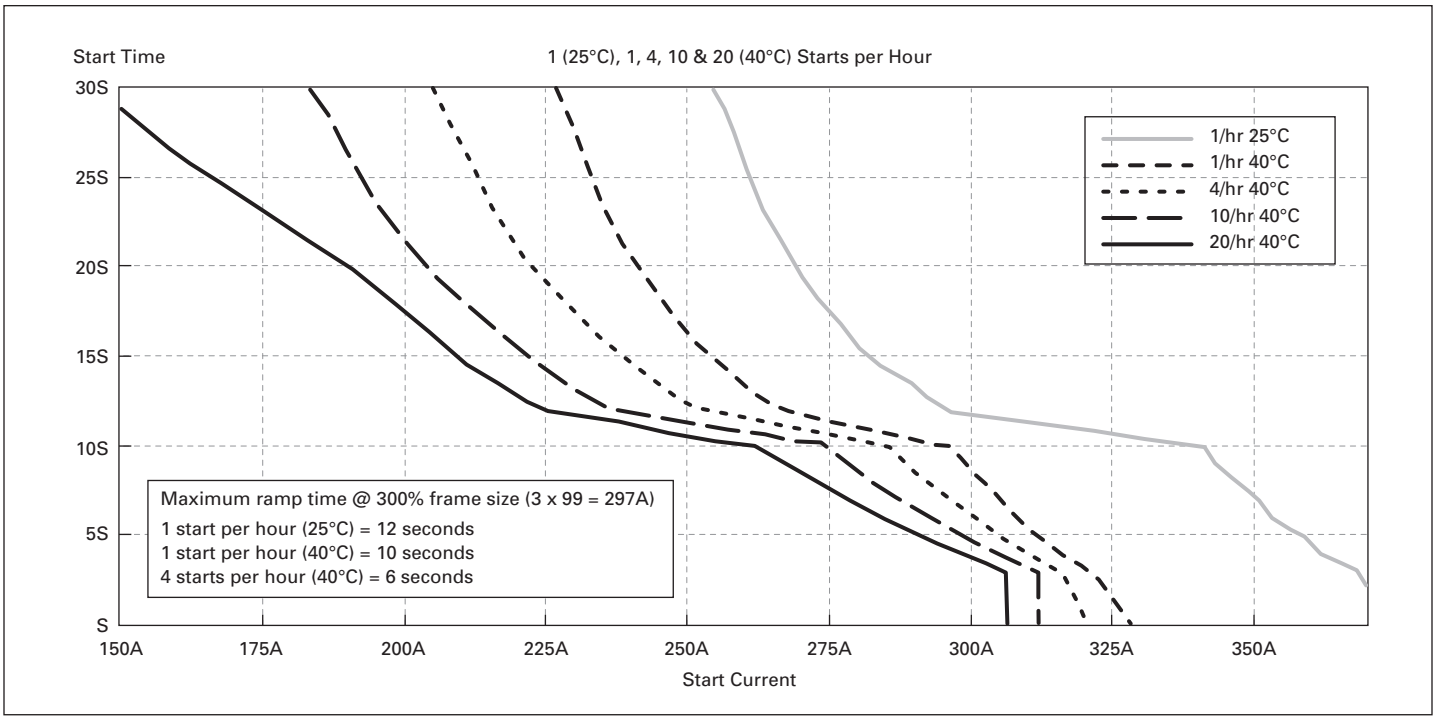

Figure 5. 99A Rated DS6-34DSX099NO-N

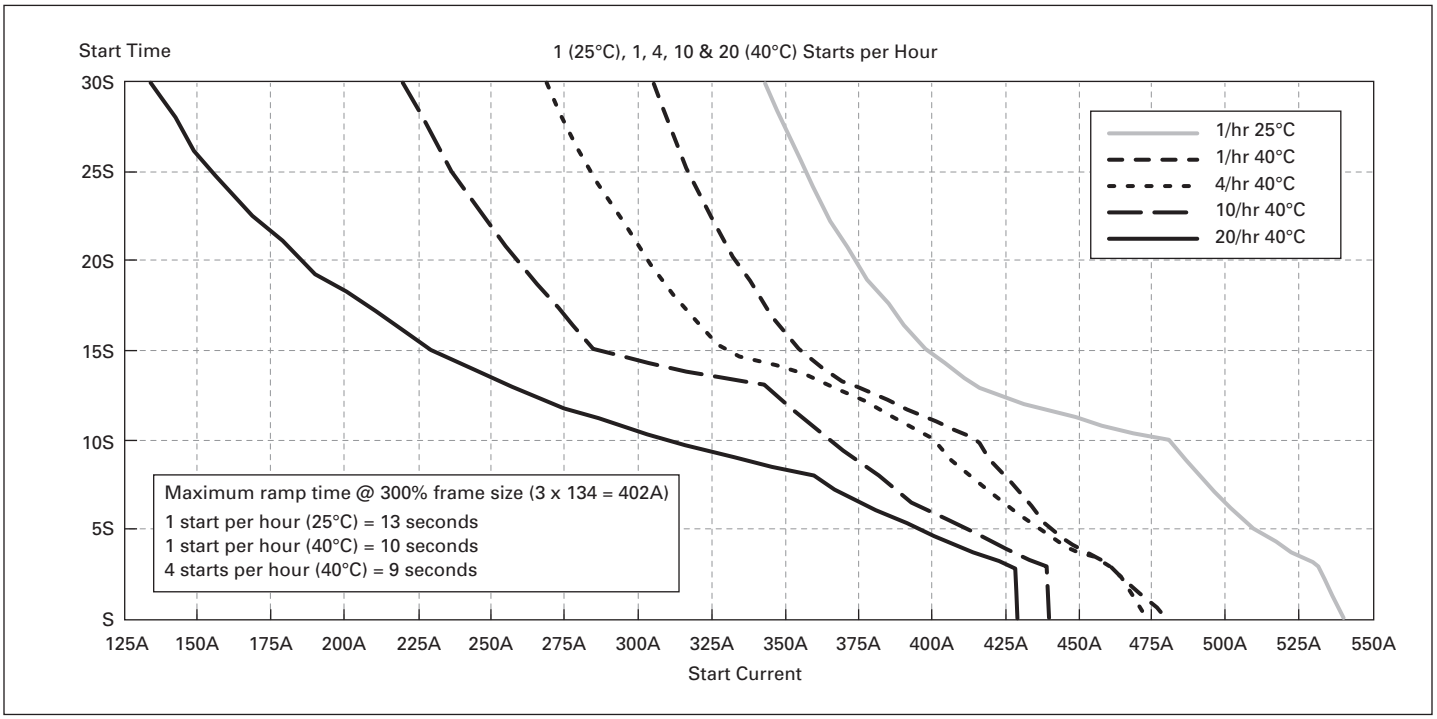

Figure 6. 134A Rated DS6-34DSX134NO-N

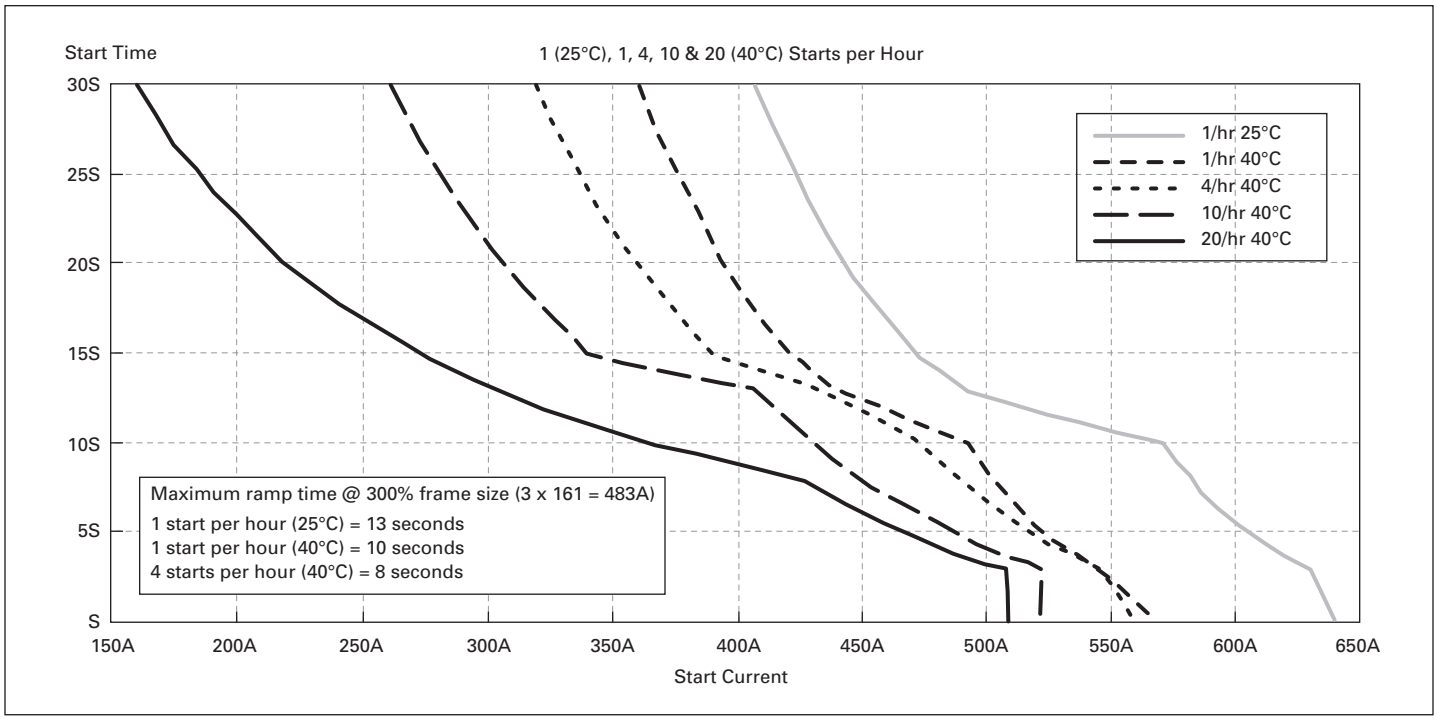

Figure 7. 161A Rated DS6-34DSX161NO-N

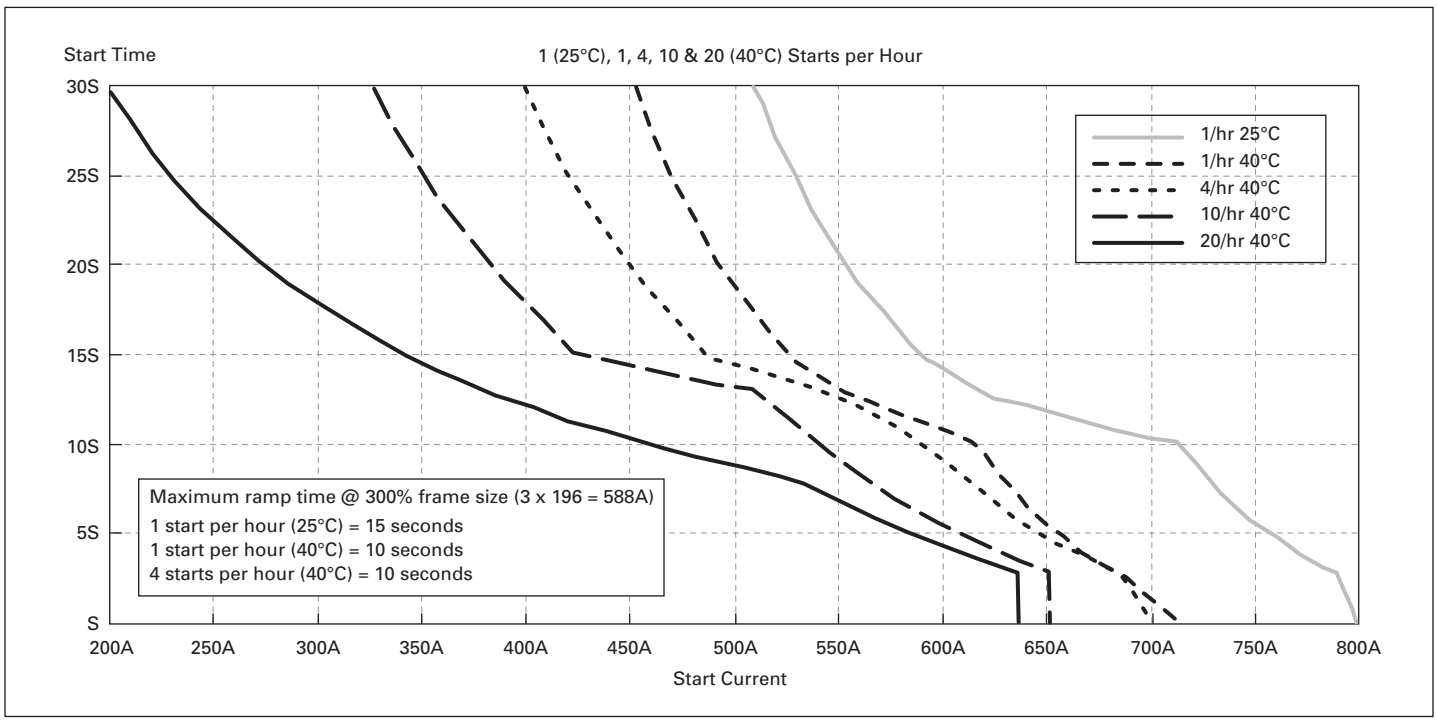

Figure 8. 196A Rated DS6-34DSX196NO-N

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